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R&D™

DEPARTMENTS

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2005 Scientist of the Year

Dr. Anthony Fauci

Director of the National Institute of Allergy and Infectious Diseases at the National Institutes of Health

pg. 30

Also in this issue:

Tim Studt

Editor in Chief
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Editorial

Government Cuts Pose Risks

For the past 15 years, growth in U.S. R&D has been supported by either industrial or government investments—when one sector was down, generally the other one was up. The net overall result has been a continuing strong growth in R&D investment. U.S. academic R&D has experienced growth throughout this period and is expected to see continued growth for several years. However, outside of long-term basic research, government and industrial investments each overshadow that of academia.

Since 2000, primary R&D growth has been from increasing federal investments, driven by defense and homeland security needs. Industrial R&D has been and is expected to remain flat for the near term. Now, the R&D investment picture is changing again. Due to budget constraints, non-defense government R&D has been forecast to decline 10% by 2009. But now, due to those same budget issues, even defense-based government R&D, which accounts for more than half of all government R&D, is expected to fall by nearly 13% by 2011—from more than $70 billion in appropriations in 2005 to about $60 billion.

Granted that even $60 billion in defense-based R&D along with an equal amount in non-defense-based R&D is a huge amount of technology investment by the U.S. government, R&D continues to be the driver in our $11 trillion economy. And without growth, we run the risk of losing the leadership, jobs, and economic stability that we now enjoy.

Viewing the economic realities that we find ourselves in, it is very likely that these budget trends, or something very similar, will occur over the next five years. We may therefore need to reevaluate how government R&D is used and how secondary commercial applications can be obtained from these investments. Many industrial companies, faced with similar economic situations, have reorganized their R&D operations to make them more efficient and productive, why shouldn't the U.S. government consider doing the same?

The fact that there is really no overall inter-agency review of the very complex government R&D investments implies that there could be dramatic efficiencies employed.

The Office of Science and Technology Policy—the agency pegged with the responsibility for proposing a balanced S&T program to the Administration—does not have the resources to compare many of the details of the R&D line items of one government agency to another. Their efforts are focused mostly on ensuring that the overall direction of U.S. S&T is supported in accord with the Administration's policy goals. R&D programs are involved in the Administration's Program Assessment Rating Tool (PART, www.whitehouse.gov/omb/part) instituted in 2002, but these tools don't really apply to inter-agency comparisons. PART evaluations are more focused on rating the performance of individual agency programs against their initial goals and current technology capabilities.

Viewing the economic realities, it is very likely that overall government R&D cuts will occur over the next five years.

However, the anticipated cuts in future government R&D will likely involve at least some of the PART evaluations as a basis of consideration. It will be interesting to view the results of the PART evaluations. Hopefully, the economic implications of these evaluations will be positive and not politically motivated.

Tim Studt

National Labs Look to Bolster Innovation Status

Executives from the nation's government labs offer insight into the challenges they currently face in securing the U.S.'s innovation edge.

In late-October, the editors of *R&D Magazine* joined with representatives from U.S. government labs at the 7th Annual R&D Government CEO Roundtable at Chicago's Navy Pier. This informal discussion sought to bring to light the issues that these executives, and indeed the laboratories that they represent, are facing today.

On the table were a variety of issues, including internal operating needs, such as recruitment and budgetary requirements, to Congressional oversight and support. Also on the agenda was the hot-button issue of U.S. leadership in innovation.

Leading the pack

There can be little doubt that the effects of outsourcing, globalization, and shifting political landscapes have changed the world stage of innovation. Countries such as China, India, and Korea have fast become technology/innovation powerhouses in their own right, closing the gap between themselves and the once omnipotent U.S. (see Global R&D Report, authored by Battele and *R&D Magazine,* www.rdmag.com).

"There is no national policy when it comes to aeronautics, this is not the responsibility of NASA, but rather a Congressional issue."

—Julian Earls

"What we are becoming more aware of is that we seem to be just a player in the international innovation community rather than a leader," says Richard Antcliff, newly-appointed director of NASA Langley's Innovation Institute, Hampton, Va.

Data from a recent survey from *The Economist Intelligence Unit* underscores this sentiment. When asked in which country companies will spend the most R&D over the next three years, 39% of respondents said China—the U.S. was second with 29%.

If the U.S. is to remain competitive, all sectors of research, i.e., academia, industry, and government will need to make a renewed investment in the people and processes that drive technological innovation. Government labs looking to do their part in this campaign, however, seem to be stifled by a series of obstacles, including those posed by the U.S. Congress.

"The fraction of the budget that we utilize for innovation or forward-looking R&D is always under fire," says Tomas Diaz de la Rubia, Associate Director for Chemistry and Material Science at Lawrence Livermore National Laboratory, Calif. "Congress absolutely does not like the laboratories having their own Laboratory Directorate Research and Development Programs, where we decide what to do with the money. It's something that we have to argue for all the time as opposed to being an integral part of the way we do business," says de la Rubia.

This problem is only further compounded by the types of projects that funding is being allocated to. "The funding I see coming into our lab seems to be more and more task-oriented as opposed to single-program driven, so that the amount of free energy to do long-range, innovative R&D keeps going down," adds de la Rubia.

Partnering up

Even with the financial and international issues they face, this year's attendees were quick to point out areas poised to serve as catalysts for U.S. innovation, including academic/industrial collaborations.

"What we are becoming more aware of is that we seem to be just a player in the international innovation community rather than a leader."

—Richard Antcliff

"The mission for the national labs in terms of innovation and long term industrial, government, and academic partnerships has yet to be defined."

—Tomas Diaz de la Rubia

"The key for national labs in helping restimulate U.S. innovation is to develop mechanisms to strengthen the relationships between the entrepreneurs, industry, and the laboratories," says Richard Stulen, Chief Technology Officer and Vice President of Sandia National Laboratories, Albuquerque, N.M. "If we lose the ability to make a robust connection to these groups, innovation will clearly go down."

Making these connections with industry, universities, and even foreign research organizations has its own fair share of obstacles, especially in the context of a U.S. national lab. "We encourage our researchers to look at research being done on other shores, but then you get into the question of what's the role of a government lab? How do we partner with international organizations if that's where the intellectual property is? If the intellectual property is out there and we just ignore it to say well we only partner with U.S. companies, that's just dumb," says Antcliff.

Bill Rogers, Associate Laboratory Director for Science and Technology and Chief Research Officer at Idaho National Laboratory, adds, "In general, partnering with international organizations, at least for Dept. of Energy labs, is just discouraged."

Participants in *R&D Magazine's* 7th Annual CEO Roundtable
Oct. 20, 2005, Chicago IL

Richard Antcliff
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Tech transfer resurgence

One strategy that does seem to be working has been the renewed strengthening of the technology transfer programs within government laboratories. "This is something we can do, bringing in professionals from the private sector who really get the outside as well as understand the laboratory culture, helping create that linkage between the research community and the outside," says Stulen.

"If we pair up with industry strategically and we sell that message back that this is the taxpayer benefit that we get from that, we can get a much stronger positioning,"

—Duncan McBranch

For its part, Sandia has put quite a bit of energy into getting a lot more focused and not simply accepting every call for help coming into the lab. "We are really trying to target industry, where the leaders that we can go after are, doing triage on this and getting a little bit smarter. As a result, we have better focused and targeted campaigns to get these connections," says Stulen.

Refining industrial connections is also on the agenda for the Technology Transfer Division at Los Alamos National Laboratory (LANL), N.M. "As part of our partnership efforts, we looked at areas where our lab is strong and happens to overlap with strong long-term needs for industry," says Duncan McBranch, Technology Transfer Division director at LANL. One example of this can be seen in Los Alamos's collaboration with industry giant Proctor & Gamble, Cincinatti, Ohio. "What does space science have to do with gingivitis? Turns out that image analysis is a strong overlap area and it is things like that where if we pair up with industry strategically and we sell that message back that this is the taxpayer benefit that we get from that, we can get a much stronger positioning," says McBranch.

Changing business models

It is the varied strengths and unique capabilities afforded by the national labs that are also driving laboratory directors and division heads to reexamine the way national laboratories do business. At Lawrence Berkeley National

"The key for national labs in helping restimulate U.S. innovation is to develop mechanisms to strengthen the relationships between the entrepreneurs, industry, and the laboratories."

—Richard Stulen

Laboratory, Calif., managers are already looking to pair up with industry, such as Intel, Santa Clara, Calif., to use its Molecular Foundry facility. "The business model that LBL is trying to develop at its Molecular Foundry is very interesting. Here LBL would in effect sponsor user groups from industry, such as Intel, to come in and use their facilities while working with students at Berkeley and LBL. If there is any intellectual property that comes out of this collaboration, this will be shared. There are potentially several business models that could come out of this which could be very interesting," adds de la Rubia.

"We at Argonne are developing a flexible type CRADA agreement that will bring people in to not just use a piece of equipment, but also work with resident scientists at the lab."

—Stephen Ban

"We need more flexible approaches," says Stephen Ban, Division Director, Office of Technology Transfer, Argonne National Laboratory, Ill. "We are developing at Argonne's Center for Nanoscale Materials a flexible Cooperative Research and Development Agreement-type (CRADA) arrangement where the Center director can approve an initial small amount of funding or a CRADA without going through all the mumbo jumbo in approvals in an effort to bring people in to not just use a piece of equipment, but also work with the resident scientists at the lab under a CRADA."

"In general, partnering with international organizations, at least for Dept. of Energy labs, is just discouraged."

—Bill Rogers

This need for newer, more flexible business models takes on an even more heightened level of importance when set against the world stage. "The Asians and Europeans all have very strong programs for industrial development backed by their governments. The government funding in these countries bring the universities, the institutes, and their industries together and they then lead initiatives in targeted areas to stimulate incredible innovation," says Stulen. "This country has taken a different approach and basically said let it happen, the good ideas will find the right partners," adds Stulen. This model, according to the panelists, may no longer be sustainable.

"If you look at the National Nanotechnology Initiative report card, you'll notice that China is taking off and will probably surpass us this year or next year in both dollars that they are investing in science and the number of start-ups and it's because of the leadership that the government is providing. So the question is whether the current model, which we've used for a long time, will still be adequate as we look out to the next 10 years? My feeling is no because the field is getting level and we are going to need to step up the government leadership," says Stulen.

Mission focus

Indeed, most of the panelists agree that government leadership, and more specifically a mission strategy, are paramount to the U.S's success in innovation. "The mission for the national labs in terms of innovation and long-term industrial, government, and academic partnerships has yet to be defined," says de la Rubia. This problem extends outside of Dept. of Energy labs into agencies such as NASA. "There is no national policy when it comes to aeronautics, this is not the responsibility of NASA but rather a Congressional issue," says Julian Earls, Director of NASA Glenn Research Center, Cleveland, Ohio.

In a time where countries such as China, India, Korea, are rapidly scaling up their commitments to technology and innovation, it will be interesting to see if the issues brought to light in this discussion become a platform for which lab directors, program managers, researchers, and senators, can actively work together to make the necessary changes. Too much is at stake not to.

—Jeannette Mallozzi

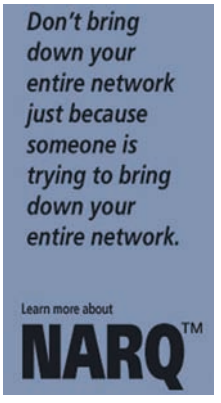
>> Resources

Dept. of Energy, Office of Science
www.er.doe.gov, 202-586-5430

National Nanotechnology Initiative
www.nano.gov

NARQ™—Network Automated Response and Quarantine

Since 1990, computer viruses and worms have cost companies worldwide nearly $2 billion in lost productivity, data, and repairs. Computer worms—programs that spread from computer to computer over a network, copying them—can bring an entire enterprise down.



As enterprise networks become increasingly complex, with hardware from disparate vendors, IT staff are becoming excessively burdened by financial constraints, organizational changes, and alarmingly aggressive cyber terrorists.

The only immediate and effective way to stop the spread of a worm is to stop it at the port—at the edge of the network. However, the problem lies not only in identifying the affected device, but also in determining where it is located on the network and immediately reconfiguring the targeted ports to shut down the infectious spread of the worm.

To combat such insidious and costly disruptions, computational scientists at Los Alamos National Laboratory, N.M., developed Network Automated Response and Quarantine (NARQ™) software to locate infected systems and reconfigure ports to remove infected devices from the network. With its instantly available graphical view of the network, NARQ™ can apply the appropriate command to disconnect the affected devices from the network. Several orders of magnitude faster than other solutions, NARQ™ was designed to work in heterogeneous, mission-critical networks and on hardware from disparate vendors.

For More Info Contact:
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Software to scrub your files clean

With hundreds of sensitive electronic documents passing through laboratory systems daily, Los Alamos National Laboratory, N.M., staff are highly sensitive to the risks of allowing proprietary or classified information to escape into the open computing environment.

To prevent this, the process of declassifying and ensuring the security of protected information is entrusted to File Scrub and File Scrub Trusted Copy, unique software developed at Los Alamos to scan electronic files to ensure removal of hidden and sensitive information.

File Scrub Trusted Copy (originally "Multi-Platform Trusted Copy") has been in use by the U.S. government since 1997. Los Alamos now hopes to partner with a company that can widely distribute and support File Scrub (for individual use) and File Scrub Trusted Copy (for use in classified/nonclassified work environments) in the government and commercial sectors.

File Scrub Trusted Copy provides a reliable method for transferring nonsensitive information from sensitive or dedicated computing environments into open environments. File Scrub reviews and cleanses files before transfer to removable media. Both applications run on Windows, Linux, Solaris, and Macintosh operating platforms.

Since inception, the File Scrub products have evolved into highly sophisticated, mature tools with far-reaching applications for information management, data security, and cyber forensics. Multiple government agencies have adopted the software as their primary means of moving vital national security documents from highly sensitive computing systems to nonsecure systems.

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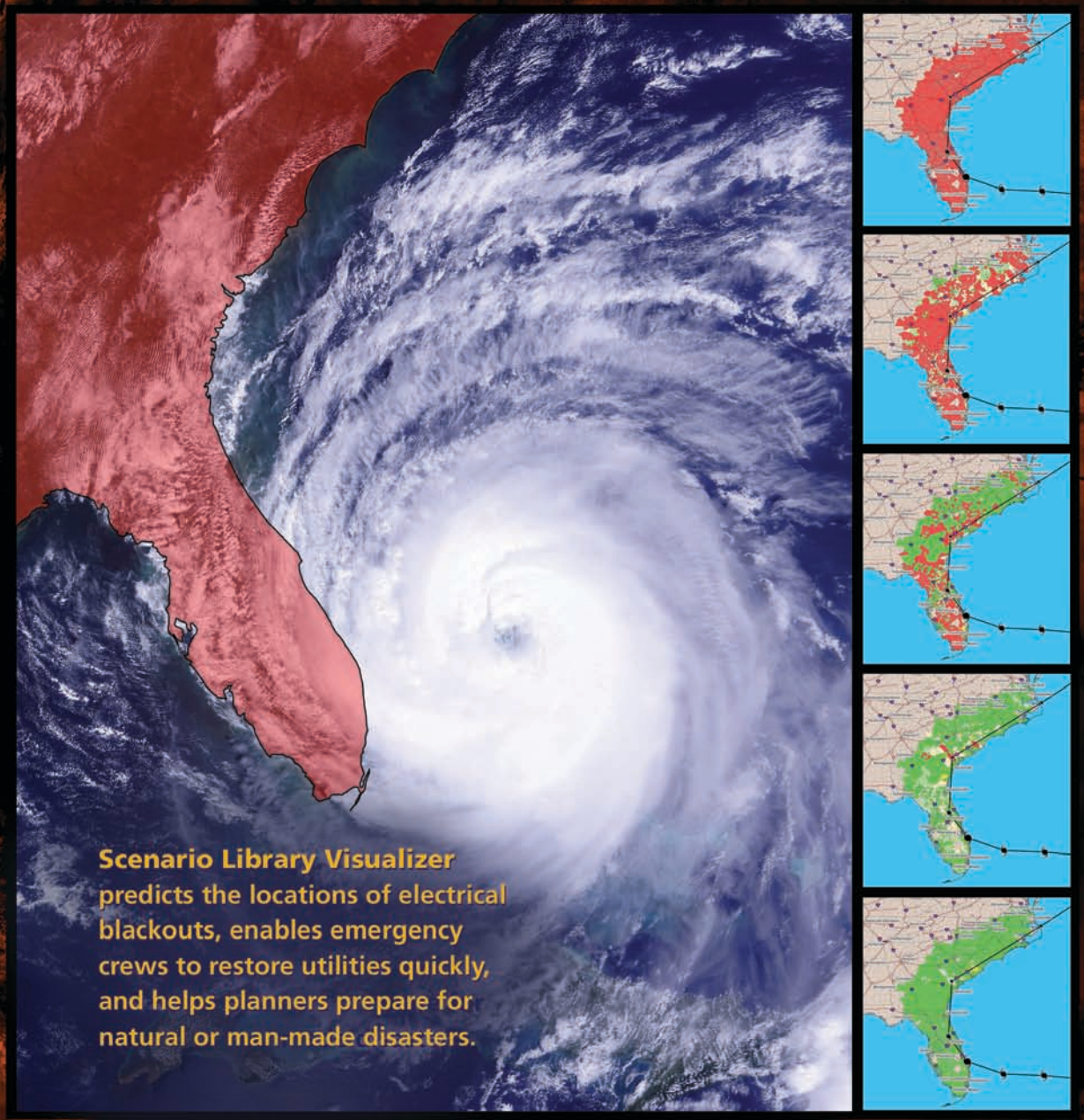
General Areas of Expertise

Organization	Advanced computers and instrumentation	Advanced engineering	Aerospace	Agri-science/Agricultural	Automotive & Transportation	Biotechnology & Pharmaceutical	Communications	Energy research	Environment	Fire Technology	Fluid dynamics	Materials research	Microelectronics and microtechnology	Oil/gas	Particle acceleration	Other
Air Force Research Laboratory	■	■	■		■	■	■	■	■	■	■	■	■	■	■	
Ames (Iowa) Laboratory	■	■		■	■	■		■	■		■	■	■		■	
Argonne National Laboratory	■	■			■	■		■	■		■	■	■	■	■	
Brookhaven National Laboratory	■	■				■		■	■			■		■	■	
Idaho National Laboratory	■	■		■	■	■	■	■	■	■	■	■	■	■	■	
Jet Propulsion Laboratory	■	■	■			■	■	■	■				■			High performance computing & simulation, homeland security technologies, forensics, high energy physics lasers
Lawrence Berkeley National Laboratory		■			■	■		■	■			■	■	■	■	
Lawrence Livermore National Laboratory	■	■			■	■	■	■	■	■	■	■	■	■	■	
Los Alamos National Laboratory	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	Homeland security, modeling and simulations, high performance computing, nanoscience, science-based prediction
NASA Ames (Calif.) Research Center	■	■	■			■	■			■	■	■				
NASA Glenn Research Center	■	■	■		■	■	■	■	■	■	■	■	■		■	
NASA Kennedy Space Center	■	■	■	■			■		■		■	■				
NASA Johnson Space Center	■	■	■	■	■	■	■		■	■	■	■	■		■	
NASA Langley Research Center	■	■	■		■		■		■		■	■	■			Non-destructive evaluation (NDE), modeling & simulation
NASA Marshall Space Flight Center		■	■								■	■				
National Renewable Energy Laboratory		■			■			■				■				
Oak Ridge National Laboratory	■	■			■	■		■	■			■	■	■	■	
Pacific Northwest National Laboratory	■	■		■	■	■		■	■		■	■	■			
Sandia National Laboratories	■	■			■	■		■	■	■	■	■	■	■		Bioscience, information science, microsystems, model/simulation, nanotech
Westinghouse Savannah River Technology Center	■	■			■	■		■	■			■				

Los Alamos National Laboratory

Laboratory teams lend high-tech skills to Hurricane Rita planning and response efforts

Los Alamos scientists provided assistance to Hurricane Rita emergency response teams as the storm was developing. On-scene in the Gulf Coast area, Los Alamos spectroscopic equipment was airborne on the EPA's ASPECT plane based out of San Antonio, while Laboratory critical infrastructure modeling teams were hard at work assessing developments in the realm of virtual reality.



Scenario Library Visualizer predicts the locations of electrical blackouts, enables emergency crews to restore utilities quickly, and helps planners prepare for natural or man-made disasters.

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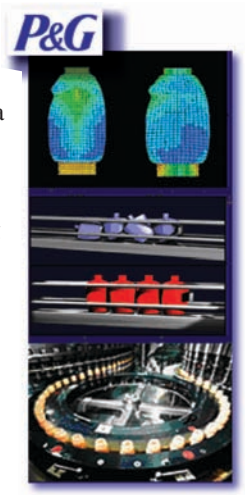
Maintaining Innovation at Los Alamos National Laboratory

From Knowledge to Products: U.S. Leads Innovation

For the past 50 years the United States has been the world leader in technology innovation through a unique combination of R&D excellence, an entrepreneurial culture, efficient access to capital, and strong demand for new products and services. Revolutionary technology advances spring from breakthroughs in fundamental understanding; basic research provides the nucleus for innovation. The national laboratories have been at the forefront of the nation's investment in fundamental science and engineering research. For example, in 2005, Los Alamos National Laboratory captured four R&D 100 Awards for projects that have implications for a wide range of industries from aerospace engineering and automotive design to drug development and personalized medicine.



Los Alamos technology saves P&G more than $1 billion in manufacturing costs.

National Labs: Meeting the Challenge

The challenge to maintain innovation leadership escalates as the world becomes more competitive and our federal investment in research continues to shrink. In addition, industry is finding it increasingly difficult to allocate money for long-term R&D that may not lead to new products short term. Most R&D managers are investing in research with an eye on the bottom line, while pondering the sources of the next generation of breakthrough technologies. Government labs must seek ways to overcome these challenges to meet a national imperative for continued technology innovation.

Los Alamos discovery could prevent catastrophic failure in deep-sea wells, saving $100 million.

At Los Alamos, we strategically reinvest revenues from license and product royalties to accelerate commercialization of technologies from long-term research efforts, like high-temperature superconductivity and fuel cells. Our Technology Maturation program has invested about $1.4 million in 32 projects over the last three years, generating an ROI of nearly $10 million. By engaging industry in providing feedback on milestones that demonstrate commercial potential for inventions still in the conceptual stage, we are narrowing the gap from discovery to production.

Los Alamos: Leading with Partners

Partnering with industry has been an area of increasing interest to Los Alamos during the past decade. We have focused on strategic relationships based on solving problems that strongly overlap both national security and industry needs. For example, our decade-long partnership with Procter & Gamble (P&G) has led to PowerFactoRE, a software and training innovation for predicting manufacturing reliability in both the weapons complex and the consumer products arena. This tool has saved P&G well over $1 billion in manufacturing costs. Our alliance with Chevron for Advanced Energy Solutions is applying Los Alamos technologies in acoustics, materials chemistry, wireless communications, and modeling to revolutionize oil and gas drilling operations to meet long-term national energy security needs.

"Working with industry to advance innovation is no longer an option, it's a necessity."

— Duncan McBranch,
Division Leader
Technology Transfer Division
Los Alamos National Laboratory

Innovation: A Global Challenge

As the national labs expand their engagement in international collaborations, technology innovation is becoming a global endeavor. Continued U.S. leadership must recognize this global context, particularly for technologies that provide solutions to energy and environmental problems.

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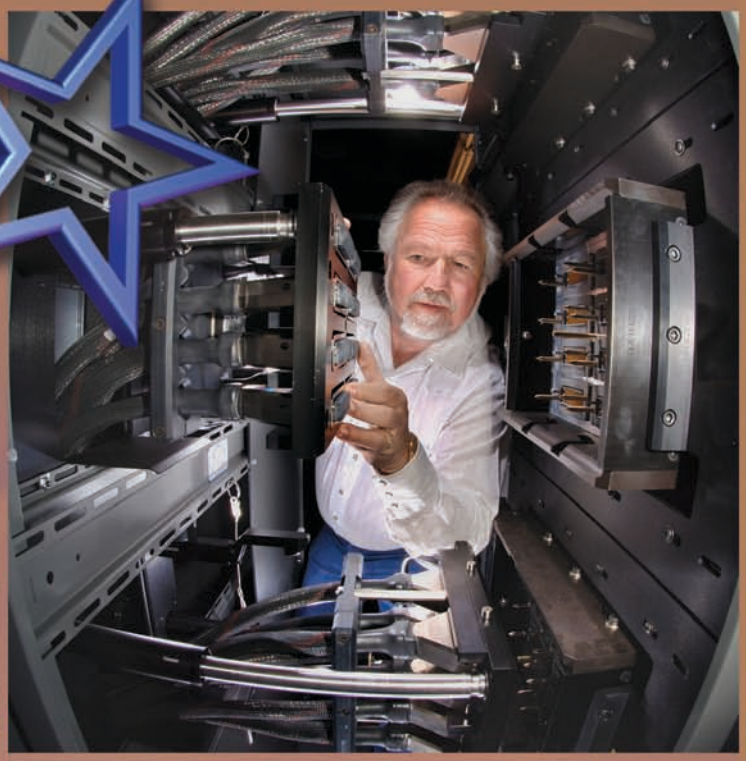
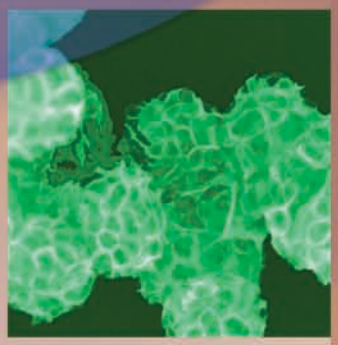
Web Site: www.lanl.gov/partnerships
Number of Employees: 7,550
Date founded: 1943

Sandia National Laboratories

Securing a Peaceful and Free World Through Technology





Sandia works closely with industry, small businesses, universities, and government agencies to bring new technologies to the marketplace.

We have been transferring technology to external partners for more than three decades, especially where such agreements benefit Sandia's primary mission of securing a peaceful and free world through technology. Discover how you can leverage the resources of a national laboratory for your benefit.

There are many ways to partner with Sandia. To find out more about Sandia's programs visit:

www.sandia.gov/bus-ops/partnerships

Infolink 065-51101-114 or call 800-441-6180

Sandia National Laboratories

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. CA.MV.11/05
Sandia is an equal opportunity employer. We maintain a drug-free workplace.

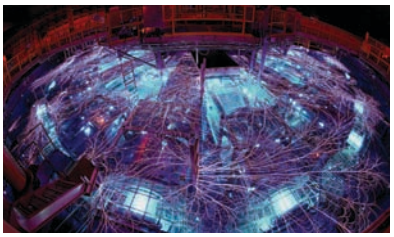
Sandia National Laboratories

Sandia National Laboratories

Sandia National Laboratories is a national security lab with the core purpose of 'Securing a Peaceful and Free World Through Technology.'

We provide technology solutions to challenging problems that threaten peace and freedom. Sandia has two primary facilities: a large laboratory and headquarters in Albuquerque, N.M., and a smaller laboratory in Livermore, Calif. We have about 8,600 employees and an annual budget of about $2.3 billion.

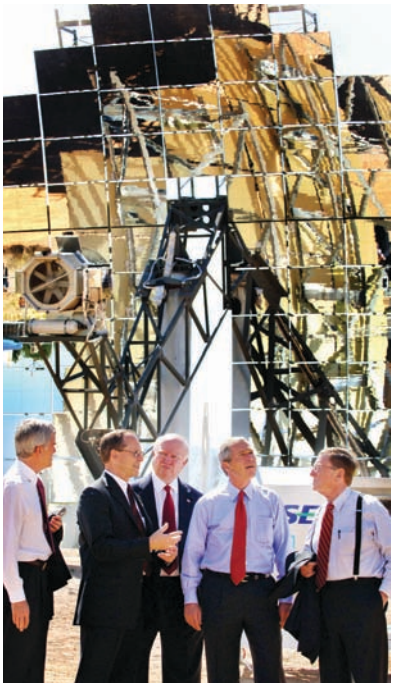
Sandia, managed by a subsidiary of the Lockheed Martin Corp., works primarily for the Department of Energy's National Nuclear Security Administration (NNSA), ensuring the safety, security, and reliability of the U.S. nuclear arsenal. Our other missions include energy and critical infrastructure R&D, nonproliferation and materials control, and developing responses to emerging national threats, including terrorism and chemical/biological warfare. Clients other than NNSA include other Department of Energy offices, the Department of Homeland Security, and the Department of Defense.



Sandia's giant "Z machine," the world's most powerful x-ray generator, is used for fusion energy research and to test the effects of radiation on weapon components.

Notable projects that Sandia has completed or is continuing to develop include:

- Ongoing cooperation with NASA to better assess damage to the space shuttle during flight and to identify when repairs need to be made,
- Synthetic aperture radar, an all-weather, day/night imaging technology that enables mapping with a precision thousands of times greater than previously possible,



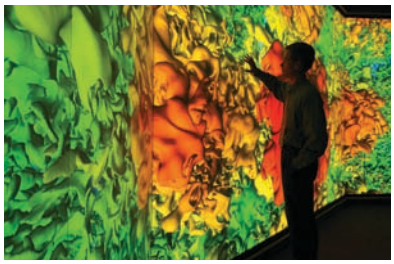
President George W. Bush traveled to Sandia in August 2005 to sign the National Energy Policy Act and tour Sandia's world-class solar test facilities.

- A hand-held MicroChemLab™ that detects chemical, biotoxin, and pathogen signatures,
- The PAN Disrupter™, a device that can disable terrorist-type bombs without detonating them,
- Radiation-hardened microchips that enable electronics in defense and space hardware to operate for extended periods in high-radiation environments,
- Technology for improving the security of power systems and dams,
- Intelligent machines and robotics that perform many security and law-enforcement tasks without putting humans in harm's way,
- Semiconductor light-emitting diodes that could eventually replace incandescent and fluorescent lighting, saving huge amounts of electricity.

Sandia's primary research specialties include:

- Computational and information sciences,
- Microelectronics and photonics sciences,
- Materials and process sciences,
- Engineering sciences, and
- Pulsed power sciences (including fusion energy R&D).

Sandia partners with U.S. industry, academia, and government agencies to accomplish its work. We have 24 user facilities—unique R&D facilities available for use by approved partners.



Computer modeling and simulation are integral to understanding complex phenomena in science and engineering. Here, a researcher studies materials interactions on a room-sized computer simulation in a visualization corridor.

Since 1976, Sandians and our partners have received 74 R&D 100 awards from *R&D Magazine* for significant technical developments.

Sandia National Laboratories
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Number of Employees: 8,600
Date founded: 1949